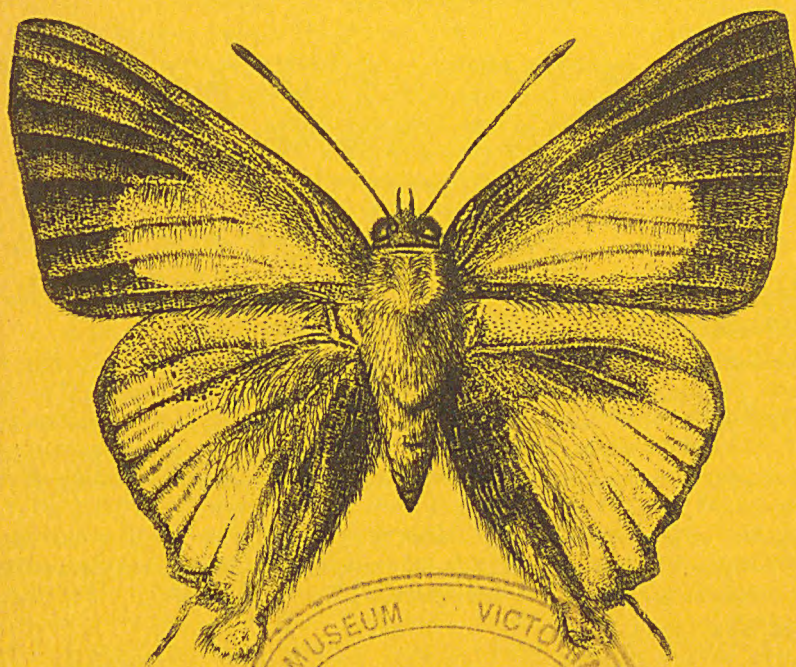


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**Cover:** The cornelian butterfly, *Deudorix diovis* Hewitson, is distributed from Cape York, Qld south to the Gosford area, N.S.W. The male is strikingly coloured orange-red and black above and pale brown below. The larvae feed within the seed capsule of several rainforest plants, including *Harpullia*, *Macadamia* and *Buckinghamia*. From an original etching by Geoff Thompson.



# A NEW SPECIES OF *TACHYTA* KIRBY (COLEOPTERA: CARABIDAE: BEMBIDIINI) FROM TROPICAL QUEENSLAND

B.P. MOORE

CSIRO, Division of Entomology, GPO Box 1700, Canberra, ACT 2601

## Abstract

*Tachyta rexensis* sp. nov. is described from rainforest habitat in northern Queensland and is compared with the two species previously recorded (from open-forest habitats) in Australia.

## Introduction

*Tachyta* Kirby is a worldwide genus of small, tachyine carabid beetles, mostly with subcortical habits. In his generic revision, Erwin (1975) recognised 19 species, of which only one, *T. brunnipennis* (Macleay, 1871), was listed from Australia. This evidently widespread species was recorded from localities in Queensland and the Northern Territory but was not known from overseas. Subsequently, Baehr (1986) described a second Australian species, *T. ovata* Baehr, that was sympatric with *T. brunnipennis* in the Northern Territory and the Ord River region of Western Australia.

During the course of a systematic survey of the Coleoptera associated with rainforest remnants in the Julatten area of northern Queensland, I collected specimens of a third Australian species of this genus, described below.

## *Tachyta rexensis* sp. nov.

(Figs 1-2)

*Types.* *Holotype* ♂, QUEENSLAND, Mowbray State Forest (western margin), Rex Range, East Julatten, 400 m, under bark of fallen rainforest tree-trunk, 26.vi.1993, B.P. Moore (Australian National Insect Collection [ANIC], Canberra). *Paratypes*: 3 ♂♂, 6 ♀♀, same data as holotype (B.P. Moore Collection, lodged with ANIC, Canberra). A female paratype will be presented to the Queensland Museum (Brisbane).

*Description.* Upperside mostly shining piceous; underside brownish; appendages clear rufous. Length 2.28-2.53 mm; maximum width 1.03-1.16 mm. Head of average width and convexity for genus, across eyes about as wide as pronotum between anterior angles, impunctate but with fine, slightly transverse microsculpture; antennae short but distinctly longer than in *T. ovata*, median segments clearly longer than wide. Pronotum impunctate, transverse, width/length about 1.7, base slightly wider than apex; sides lightly curved from apex almost to base, then slightly sinuate before posterior angles, the latter sharp; marginal channel narrow; prebasal impression and median line well marked, lateral carinae weak; surface impunctate, microsculpture faint. Elytra elongate-oval, convex, length/width about 1.35; sides slightly sinuate behind shoulders and near apex, widest behind middle; only the sutural striae complete, 3 others traceable on disc as rows of fine punctures but successively increasingly faint; discal setae within 4th intervals, adjacent to 4th striae, intervals impunctate, microsculpture very fine

fine and inconspicuous. Aedeagus (Fig. 2) similar to that of *T. ovata*; internal sac only slightly sclerotised; parameres 3-setose.

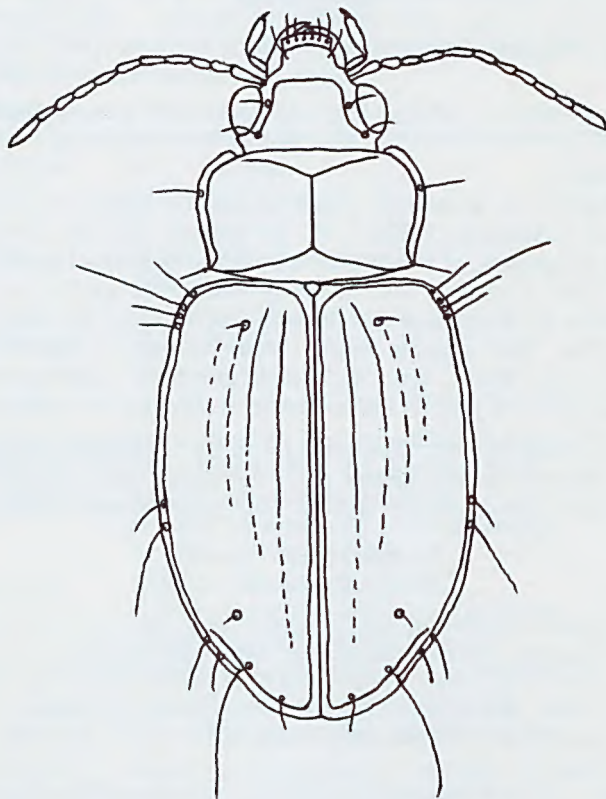
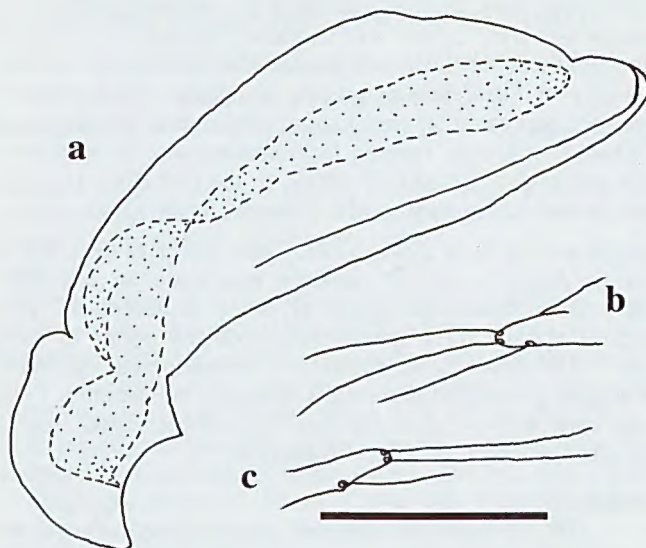


Fig. 1. *Tachyta rexensis* sp. nov., holotype male; natural length = 2.53 mm.

*Comments.* Together with the two other species known from Australia, this new species evidently belongs to the subgenus *Tachyta sensu stricto*, as restricted by Erwin (1975) to species with evident microsculpture; it differs from both *T. brunnipennis* (Macleay) (2 syntypes [ANIC] and 5 other specimens examined) and *T. ovata* Baehr (holotype and 2 paratypes [ANIC] examined) in its much less obvious sculpture, giving a more shining integument. The elytra in the new species are less elongate than in *T. brunnipennis* but slightly more so than in *T. ovata*. However, the antennae in *T. ovata* are markedly shorter than in the other two species. These differences may be expressed in the form of a revised key to the Australian species of *Tachyta*.





**Fig. 2.** *Tachyta rexensis* sp. nov., aedeagus: (a) median lobe in left lateral view, with parameres detached; (b) apex of right paramere; (c) apex of left paramere. Scale line = 0.1 mm.

### Key to Australian species of *Tachyta*

- 1 Rather elongate species, ratio length/width of elytra over 1.4; surface of pronotum and elytra strongly punctate between microsculpture, integument rugose and dull ..... *T. brunnipennis* (Macleay)
- Wider, convex species, ratio length/width of elytra 1.35 or less; surface of pronotum and elytra finely punctate or impunctate between microsculpture, integument scarcely or not rugose ..... 2
- 2 Integument rather shining; antennae longer, the intermediate segments clearly longer than wide ..... *T. rexensis* sp. nov.
- Integument rather dull; antennae shorter, the intermediate segments about as wide as long ..... *T. ovata* Baehr

### Discussion

Unlike its two Australian congeners, *T. rexensis* appears to be confined to rainforest, but all three species have been collected from beneath the bark of fallen timber. *T. rexensis* was discovered during an extensive survey of the Coleoptera of the Julatten area of tropical Queensland, being conducted by the present author. Apart from the type series (which was only a small proportion of the population present on the tree-trunk), other, single

specimens were taken from neighbouring but isolated patches of such forest. *T. brunnipennis* also featured in this survey but only as occasional records from the southwest of the Julatten area, where rainforest blends with more open *Acacia*- or *Eucalyptus*-dominated woodland. Thus, these two species are probably parapatric in this region, although *T. brunnipennis* shows a much wider distribution, ranging from southeastern Queensland, across the northern part of the Northern Territory, to the Ord River region of Western Australia, where it is sympatric with *T. ovata* (Baehr 1986).

As pointed out by both Erwin (1975) and Baehr (1986), the presence of *Tachyta* in Australia almost certainly represents an intrusion from the Oriental region, where the genus is richly represented. However, the existence of at least three species here probably points to more than one invasion. Of these three species, *T. brunnipennis* would appear on morphological grounds to represent a separate line, whereas *T. rexensis* and *T. ovata* may well be sister species that differentiated from a common ancestor after its arrival in tropical Australia.

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# NEW RECORDS OF TEPHRITINAE (DIPTERA: TEPHRITIDAE) FROM AUSTRALIA AND THE SOUTH PACIFIC

D.L. HANCOCK<sup>1</sup> and D.J. McGUIRE<sup>2</sup>

<sup>1</sup>PO Box 2464, Cairns, Qld 4870

<sup>2</sup>Australian School of Environmental Studies, Griffith University, Nathan, Qld 4111

## Abstract

New distributional or host plant records are provided for seven species of Tephritinae. Records of *Dioxya brachybasis* Hardy from Niue, Cook Is, French Polynesia and Fiji are considered to be misidentifications of the variable *D. sororcula* (Wiedemann).

## Introduction

Flower-infesting species of fruit flies, placed in the subfamily Tephritinae, are gaining importance as potential biological control agents, yet information on their distribution and host plants is relatively sparse for both Australia and South Pacific countries. Most available information was summarised by Hardy (1988), Hancock and Drew (1994) and Hardy and Drew (1996). Additional information is provided below, mostly from the collection of the Zoological Museum, University of Copenhagen (ZMUC), plus a few records from the Australian National Insect Collection, Canberra (ANIC) and Queensland Department of Primary Industries, Brisbane (QDPI).

## Systematics

### Tribe Tephrellini

#### *Sphaeniscus atilius* (Walker)

**Material examined.** AUSTRALIA: 1 ♂, Northern Territory, Baroalba Creek Springs, 19 km NE by E of Mt Cahill, 28.x.1972, D.H. Colless (ANIC); 1 ♀, New South Wales, The 5 Islands [4], Wollongong, 13.iii.1936, D.F. Waterhouse (ANIC).

**Comments.** Although previously reported from Australia (Hardy and Drew 1996), the above are the first published locality records for this widespread species. In Southeast Asia it breeds in the flowers of *Hyptis* spp. (Labiatae).

### Tribe Tephritini

#### *Dioxya conflicta* (Curran)

**Material examined.** NEW CALEDONIA: 3 ♂, 6 ♀, Yahoue, iii.1978, N.L.H. Krauss; 2 ♂, Noumea, iii.1978, N.L.H. Krauss. VANUATU: 12 ♂, 5 ♀, Efate, Vila, xii.1978, N.L.H. Krauss. TONGA: 10 ♂, 16 ♀, Tongatapu, Nuku'alofa, i & ii.1978, i.1980, N.L.H. Krauss; 2 ♂, Tongatapu, Kolovai, 29.i.1979, N.L.H. Krauss; 2 ♂, 4 ♀, Vava'u, i.1978, N.L.H. Krauss. WESTERN SAMOA: 2 ♂, Upolu I., Mulivai, i.1978, N.L.H. Krauss. NIUE: 26 ♂, 18 ♀, Alofi, i.1978 & xii.1979, N.L.H. Krauss (all ZMUC).

**Comments.** Newly recorded from Vanuatu, Tonga, Samoa and Niue.

#### *Dioxya sororcula* (Wiedemann)

**Material examined.** AUSTRALIA: 3 ♂, 2 ♀, Queensland, Atherton, 30-31.x & 3-18.xi.1972, A.M. Hemmingsen. WESTERN SAMOA: 3 ♂, 1 ♀, Upolu I., Mulivai, i.1978, N.L.H. Krauss. NIUE: 1 ♂, Alofi, xii.1979, N.L.H. Krauss. COOK ISLANDS: 16 ♂, 19 ♀, Aitutaki, xii.1977, N.L.H. Krauss; 28 ♂, 20 ♀, Rarotonga, xi-

xii.1977 & iii.1979, N.L.H. Krauss. FRENCH POLYNESIA: 1 ♂, 2 ♀, Austral [Tubuai] Is, Rurutu, xii.1977, N.L.H. Krauss (all ZMUC).

*Comments.* This widespread species is newly recorded from Western Samoa and Niue. The wing pattern is a little variable, cell  $r_1$  sometimes having two instead of three hyaline spots on one or both wings and previous records of *D. brachybasis* Hardy from Niue, Cook Is, French Polynesia and Fiji (Hardy 1988, Hancock and Drew 1994) belong to *D. sororcula*.

*Hendrella sexincisa* (Malloch)

*Material examined.* AUSTRALIA: 1 ♂, Queensland, Atherton, 3-18.xi.1972, A.M. Hemmingsen (ZMUC).

*Comments.* Newly recorded from northern Queensland.

*Rhabdochaeta crockeri* Curran

*Material examined.* SOLOMON ISLANDS: 42 ♂♀, Guadalcanal, Bagi, 16 & 23.i.1995, R. Wylie *et al.*, bred from flowers of *Wedelia biflora* (QDPI); 1 ♂, 2 ♀, W Guadalcanal, Lavuro, 19.vii.1995, R. Hollingsworth (QDPI).

*Comments.* *Wedelia biflora* (Asteraceae) is the first host record for this species. It was misspelt 'cockeri' by Hardy and Drew (1996).

*Spathulina acroleuca* (Schiner)

*Material examined.* AUSTRALIA: 2 ♂, 1 ♀, Queensland, Atherton, 30-31.x & 3-18.xi.1972, A.M. Hemmingsen. SOLOMON ISLANDS: 2 ♀, Vanikoro, St Cruz, 22.viii.1934. VANUATU: 12 ♂, 5 ♀, Efate, Vila, xii.1978, N.L.H. Krauss. FIJI: 7 ♂, 4 ♀, Viti Levu, Nandi, ii.1978 & iii.1980, N.L.H. Krauss. TONGA: 23 ♂, 10 ♀, Tongatapu I., Kolovai & Nuku'alofa, i & ii.1978, i.1979, i.1980, N.L.H. Krauss; 11 ♂, 13 ♀, Vava'u, i.1980, N.L.H. Krauss. WESTERN SAMOA: 10 ♂, 8 ♀, Upolu I., Mulivai, Vailima & Apia, i.1978, N.L.H. Krauss. AMERICAN SAMOA: 1 ♂, 1 ♀, Pago Pago, 18.iv.1934. NIUE: 6 ♂, 8 ♀, Alofi, i.1978 & xii.1979, N.L.H. Krauss. FRENCH POLYNESIA: 3 ♂, 1 ♀, Tahiti, Punanina, xii.1977, N.L.H. Krauss (all ZMUC).

*Comments.* This widespread species is newly recorded from Vanuatu, Niue and French Polynesia.

*Tetreuaresta obscuriventris* (Loew)

*Material examined.* TONGA: 4 ♂, 8 ♀, Tongatapu, Nuku'alofa, ii.1978 & i.1980, N.L.H. Krauss (ZMUC); 1 ♂, 2 ♀, Tongatapu, Kolovai, 29.i.1979, N.L.H. Krauss (ZMUC); 1 ♂, 1 ♀, Vava'u, i.1980, N.L.H. Krauss (ZMUC).

*Comments.* This New World species has been introduced to Fiji and Tonga for the biological control of *Elephantopus mollis* (Asteraceae).

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## THE LIFE HISTORY OF *TELICOTA BRACHYDESM* LOWER (LEPIDOPTERA: HESPERIIDAE)

P.S. VALENTINE<sup>1</sup> and S.J. JOHNSON<sup>2</sup>

<sup>1</sup>Tropical Environment Studies & Geography, James Cook University, Townsville, Qld 4811

<sup>2</sup>Oonoonba Veterinary Laboratory, PO Box 1085, Townsville, Qld 4810

### Abstract

The immature stages of *Telicota brachydesma* Lower are described from northern Queensland (Iron Range National Park, Cape York Peninsula). The larval food plant is confirmed as *Leptaspis banksii* (Poaceae), which has a restricted distribution within rainforest. We comment on the apparent rarity of this species in collections and include characteristics to assist in its identification.

### Introduction

*Telicota brachydesma* Lower is the smallest and least known of the Australian species of *Telicota* Moore. Common and Waterhouse (1981) considered the species rare and indicated a distribution from the Claudie River (Iron Range) to Mackay. They noted that the 'larvae feed on *Leptaspis banksii* (Poaceae) growing in rainforest' but did not give a source for this observation. There is no published description of immature stages. In our experience specimens of this species are uncommon in collections and identification of field collected individuals has been difficult. Despite careful searching for adults, known to occur in rainforest habitat, we had been unable to locate any populations. We therefore decided to attempt to find areas of the presumed larval food plant as a means of locating possible colonies of this skipper.

We failed to discover a published photograph or illustration of *L. banksii* and the James Cook University Herbarium had no specimen. However, Mr Peter Stanton, former field botanist and research ecologist with the Queensland Department of Environment and Heritage, provided us with a specimen of this quite distinctive small grass and indicated that it occurred only in very well developed rainforest. Jones (1986) describes the plant occurring in 'shady rainforests where it often grows in rocky situations'. With this information we deliberately searched the rainforests of Iron Range National Park and near Cooktown, previously known locations for *T. brachydesma*. In this paper we describe the immature stages discovered as a result of the searches and provide brief descriptive notes to enable identification of the adults.

### Life History

**Food plant** (Fig. 1). *Leptaspis banksii* R. Br. (Poaceae).

**Egg** (Fig. 5). Hemispherical, white; surface covered in very fine reticulated pattern; 1.0 mm diameter, 0.6 mm high.

*First instar larva.* Head black, body pale cream, prothoracic plate black, anal plate bearing 2 pairs of long pale grey setae laterally; length 1.5-2.0 mm, diameter 0.5 mm.

*Second instar larva.* Head black, body greenish translucent and smooth except for anal plate; faint thin white lateral line joining spiracles; length 10 mm, diameter 1.5 mm.

*Third and fourth instar larvae* (Figs 2, 3). Head pale brown, crenulated, frons with central brown stripe, mandibles and ocelli dark brown, body translucent greenish, smooth except for final segment, anal plate and prolegs all with short white hairs; green gut provides greenish body colour; fine white lateral line joining yellow spiracles; anal plate with variable semicircular black area on perimeter; length 13 mm, diameter 2 mm.

*Final instar larva.* The final instar becomes pinkish or pale purple with distinct ventral white patches developing prior to pupation; length 18 mm.

*Pupa* (Figs 4, 6). Brown, thorax and cremaster darker coloured; uniformly tapered posteriorly; eyes prominent with small lateral patches of hairs; setae simple, erect, sparse on thorax and 6 bands per abdominal segment; silver dusting adjacent to prothoracic spiracles; antennae project ventrally beyond wing cases to form a short unattached tip; cremaster dorsoventrally flattened with deep dorsal pit, lateral points posteriorly and armed with 20 hooks; length 16 mm.

### Observations and Discussion

The larval food plant is a distinctive grass (Fig. 1) confined to the more dense stands of closed rainforest. Eggs are laid singly on the underside of a leaf blade and first instar larvae make shelters by silking the sides of the blade ventrally into a tube 8-10 mm long and 1.5 mm diameter. The larvae rest with head facing towards the stem of the blade and feed in irregular patches along the leaf blade edge. As the larvae grow the shelters are extended along the mid-rib and feeding reduces the leaf blade area. Eventually some leaf blades are completely consumed to the mid-rib. By third instar the shelters are considerably larger, being 40-50 mm in length and 4-5 mm diameter. At this stage larvae leave their shelters and feed on adjacent blades.

Final instar larvae leave the plant and construct shelters for pupation in older dead leaves which droop around the stems of the plant, or occasionally in leaf litter at the base of the plant. These are silked to form a vertical shelter. Pupation occurs in a head up position in the shelter which is sealed and contains white waxy powder within it (Fig. 4). It is presumed that the white ventrolateral patches noted in final instar larvae and prepupae produce the water repellent powder which is found within the pupal shelter, a feature shared by many other hesperiids. Larvae of all instars were taken to Townsville for rearing where larval and pupal durations between June and September were 20-25 days and 12-15 days respectively.





**Figs 1-5.** *Telicota brachydesma*: (1) larval food plant *Leptaspis banksii*; (2) fourth instar larval head; (3) fourth instar larva; (4) pupa within final shelter; (5) egg. Scale bars: (3) = 2 mm, (4) = 5 mm, (5) = 0.5 mm.

At Iron Range, Rocky River and Cooktown we found substantial stands of *L. banksii* in areas of dense, closed canopy rainforest. Signs of larval feeding were present at all sites and larvae were common at Iron Range in May, December and August and at Cooktown in May. At Iron Range we located >50 larvae of all instars in a patch of *L. banksii* covering an area of around 60 m x 40 m (0.24 ha). Wherever we found the grass we found larvae or signs of larval feeding. Each clump would usually have only a single larva but occasionally two or more were found. Many clumps were devoid of larvae. Despite spending several hours in the areas observing we did not record any adult *T. brachydesma*. Visibility in such conditions is restricted and it is possible that females were ovipositing in the area but were not observed.

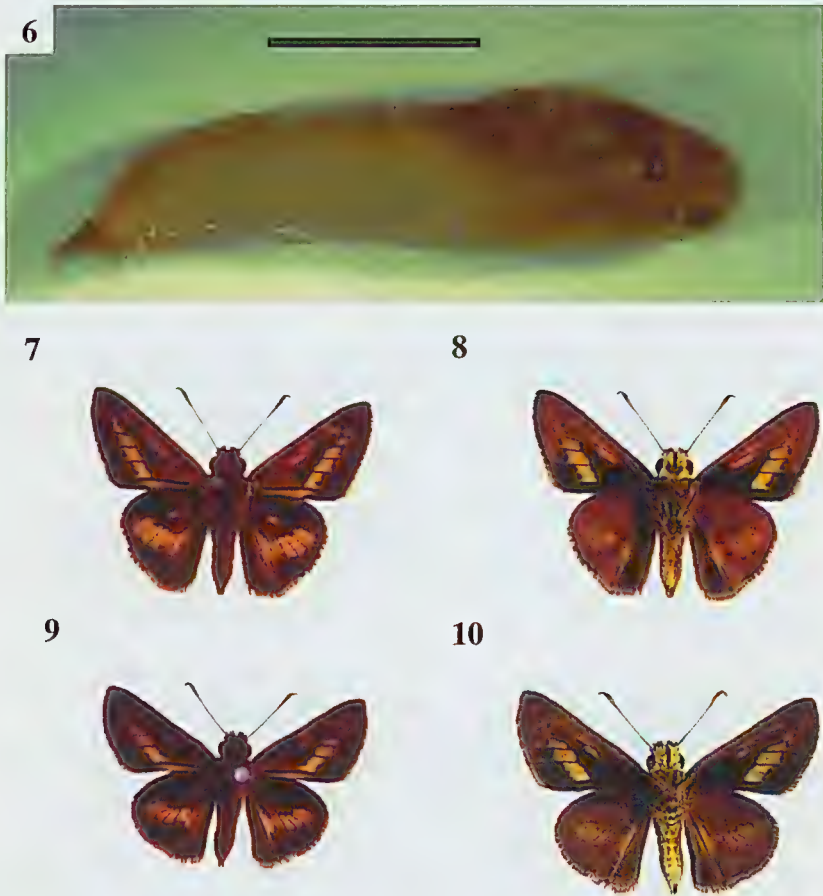
Based on the numbers of larvae discovered it is perhaps surprising that *T. brachydesma* is so poorly represented in collections. One likely explanation is that adult males may congregate in the rainforest canopy and, if females are confined primarily to areas with the larval food plant, they will also be difficult to see and rarely collected. The distribution of the larval food plant, according to Queensland Herbarium records (Henderson 1997), coincides with the Mackay to Claudie River distribution of *T. brachydesma* given by Common and Waterhouse (1981).

Until now, very few specimens of *T. brachydesma* have been available for comparative studies and this has led to occasional confusion and conjecture (Dunn and Dunn 1991). The descriptions published in major texts (Waterhouse and Lyell 1914, Waterhouse 1932, Common and Waterhouse 1972, 1981) have changed little and are accurate and sufficient to enable separation of *T. brachydesma* from other *Telicota* spp. known to occur in Australia. However, the illustrations in Common and Waterhouse (1972, 1981) are inaccurate and not consistent with the textual descriptions. We have examined a larger series from Claudie River and Cooktown and they agree closely with the published descriptions. Wingspans of both sexes are listed in Table 1.

**Table 1.** Wingspans of *Telicota brachydesma* (mm).

	Males n = 20	Females n = 18
Mean	25.0	24.24
Median	24.9	23.9
Smallest	22.4	23.2
Largest	26.9	27.2
Std Deviation	1.26	1.13
Std Error	0.28	0.27





**Figs 6-10.** *Telicota brachydesma*: (6) pupa lateral view (scale bar = 5 mm); (7) male upperside; (8) male underside; (9) female upperside; (10) female underside.

Males of *T. brachydesma* (Figs 7-8) are distinguished by their small size, dark ground colour above, narrow dark sex brand, orange markings that do not extend along the veins towards the margins of the forewings and deep red-brown colour and indistinct post-median band on the hindwing beneath.

In general facies, males of *T. brachydesma* are closest to males of *T. ohara* (Plötz) and *T. anisodesma* Lower but these latter species are much larger, have paler and broader sex brands and on the forewings the orange suffusion extends along the veins towards the margins. In size, male *T. brachydesma* approach males of *T. mesoptis* Lower and *T. augias* (L.). *T. mesoptis* males

have yellow bands, a paler sex brand and the hindwing beneath is yellow with a faint greenish tinge and prominent post-median band. *T. augias* males have a broader sex brand, more extensive orange markings above which extend along the veins to the margins of the forewings and the ground colour beneath lacks the deep reddish hue.

Females of *T. brachydesma* (Figs 9-10) can be distinguished by their small size, dark ground colour above, cell spot reduced in the forewing and vestigial or absent in the hindwing and the deep red brown suffusion and indistinct post median band on the hindwing beneath.

### Acknowledgments

We particularly thank Peter Stanton for assistance with the food plant identity and ecology, Mick and Clare Blackman for assistance in the field and the Queensland Department of Environment and Heritage for permits to work in areas under their control.

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## THE LIFE HISTORY OF *NESOLYCAENA MEDICEA* BRABY (LEPIDOPTERA: LYCAENIDAE)

S.J. JOHNSON<sup>1</sup> and P.S. VALENTINE<sup>2</sup>

<sup>1</sup>Oonoomba Veterinary Laboratory, PO Box 1085, Townsville, Qld. 4810

<sup>2</sup>Tropical Environment Studies and Geography, James Cook University, Townsville, Qld. 4811

### Abstract

*Nesolycaena medicea* Braby is recorded breeding on *Boronia eriantha* Lindl. (Rutaceae) in the sandstone gorges of The White Mountains in inland northern Queensland. Larval and pupal durations are short during summer but pupae enter diapause with the onset of cooler, drier weather. Comments are made on adult variation.

### Introduction

*Nesolycaena medicea* Braby was described from four adults taken in early spring, flying in deep sandstone gorges in The White Mountains National Park, near Torrens Creek in northern Queensland (Braby 1996), but the biology of the species has remained unknown. Further morphological information is now available and preliminary studies on the conservation biology of the species have uncovered details of the life history.

### Life history

*Food plant.* *Boronia eriantha* Lindl. (Rutaceae).

*Egg* (Fig. 1). White, hemispherical, 0.65 mm wide, 0.4 mm high; surface finely pitted and overlaid with a reticulate pattern of crenulate ridges forming mostly quadrate pits; micropyle smooth.

*First instar* (Fig. 2). Pale yellow; entire margin slightly scalloped; each segment bearing a pair of setae dorsolaterally and 2-3 long pale setae on the lateral margin; mandibles brown; spiracles black; anal plate with faint brown markings.

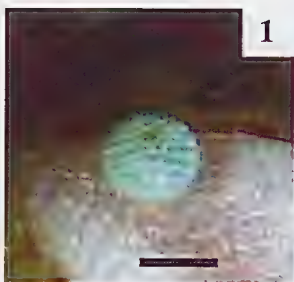
*Second to fourth instar.* Green; dorsal protuberances more pronounced and margin deeply indented; dense line of setae along ventrolateral margin; head retracted beneath prothorax; length 4-7 mm.

*Final instar* (Fig. 3). Green; dorsal heart darker green faintly edged white; prominent white lateral line; prothoracic plate smooth, grey, densely covered in reddish brown spots and flecks; spiracles cream; length 8-10 mm.

*Pupa* (Fig. 4). Cream brown, densely covered in black flecks and blotches more pronounced on lateral thorax, along dorsum and on intersegmental areas of abdominal flange; prothorax slightly concave; slight dorsal flange; a pair of rounded protuberances dorsally and laterally on mesothorax; lateral margin of abdominal segments flanged and occasionally suffused pink posteriorly; attached by cremaster and central girdle; length 8-9.5 mm.

### Discussion

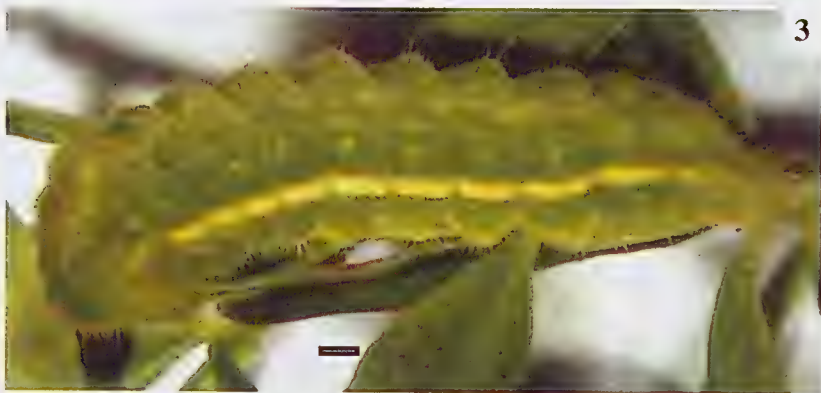
Eggs were usually laid singly on flower buds or on petals within opened flowers but occasionally under terminal leaves. First instar larvae did not feed on flowers but tunnelled into soft growing tips of the plant where they



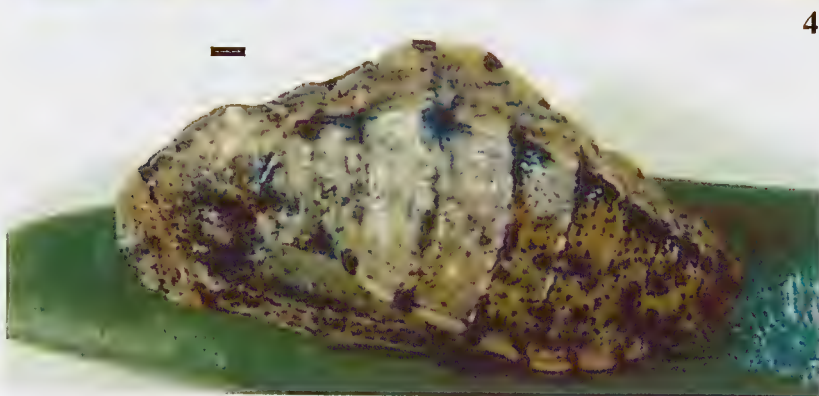
1



2



3



4

**Figs 1-4.** *Nesolycaena medicea*: (1) egg; (2) first instar larva; (3) final instar larva; (4) pupa. Scale bars = 0.5mm.





5



6

Figs 5-6. *Nesolycaena medicea*: (5) male upperside; (6) female upperside.

remained almost completely buried for 48 hours before moving to the underside of a leaf to moult. Second instar larvae fed on the epidermis on the underside of mature leaves and later instars fed on the margins of leaves. Larger larvae remained fully exposed on the foliage, typically resting along the upper surface of a leaf with the head deflexed over the tip (Fig 3). In this position the larvae blended well and were difficult to see but were easily dislodged by gentle shaking of the plant. Several early instar larvae were transferred to *Boronia keysii* and completed development and emerged as full sized adults in similar time as other larvae reared on *B. eriantha*. In the field pupae were found in curled dead leaves adjacent to the base of the food plant. The size, shape and colour of the pupa closely matched the decomposed sandstone in which the host plants grew. Larvae and pupae were not attended by ants.

Egg, larval and pupal durations in December, February and March were 4-5, 24-26 and 10-12 days respectively. Some larvae pupating in late summer entered diapause. A pupa collected in the field on 14 March 1999 and taken to Townsville, emerged 235 days later on 4 November following a week of rain and high humidity. A similar pupal diapause has been reported by Common and Waterhouse (1981) for *N. urumelia* (Tindale) and is recorded here by us for *N. caesia* d'Apice & Miller, where a larva that pupated in Kalumburu on 11 April 1995 and taken to Townsville emerged 253 days later on 20 December.

Adults were common between December and April, flying in upper and lower gorges and usually confined to areas where *B. eriantha* grew but, in December 1998, several females were observed flying across a dry ridge separating the gorges of the Flinders River and Torrens Creek watersheds. In February 2000, following heavy rainfall that commenced in the previous October and November, adults were abundant and occasional specimens were observed flying in areas devoid of *B. eriantha*.

The collection and rearing of a much larger series of fresh material has enabled a better definition of adult variation. Males (Fig. 5) appear uniform and consistent with the original description except that the sex brand on the bases of veins CuA<sub>1</sub> and CuA<sub>2</sub> is more prominent than in the specimen illustrated by Braby (1996). Females are slightly more variable with occasional specimens (Fig. 6) showing reduced greyish-white suffusion on the upperside of both wings.

### Acknowledgments

We thank the Queensland Herbarium for food plant identification and the Department of Environment for permits to work in areas under their control.

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**FIRST RECORD OF WHITE MONARCHS,  
*DANAUS PLEXIPPUS* (L.) FORM *NIVOSUS* (LEPIDOPTERA:  
NYMPHALIDAE: DANAINAE) FROM VANUATU**

M.S. MOULDS and R.B. LACHLAN

*Australian Museum, 6 College St, Sydney, NSW 2000*

### Abstract

The only previously known established population of white monarch butterflies, *Danaus plexippus* (L.) form *nivosus* Gunder, is that found on the Hawaiian island of Oahu. This paper records a second established population, restricted to the island of Aneityum (= Anatom), Vanuatu. The discovery of this second population provides the first opportunity for hybridization experiments which may shed light on the origin of the 'nivosus' gene.

### Introduction

The 'white' form of *Danaus plexippus* (L.), known as *nivosus* Gunder, is a conspicuous morph in which the normal bright orange of the wings is replaced by white that is slightly tinted pink or grey. For the most part this is a rare phenotype, although it became increasingly abundant on the Hawaiian island of Oahu before declining (Stimson and Kasuya 2000). Other isolated records listed by Vane-Wright (1993) are from Washington D.C., Missouri, Pennsylvania and the coast of California in continental USA, plus the North Island of New Zealand, Ambon and Seram in the Moluccas, Indonesia and Brisbane, Australia. We are aware of one further record recently published (Minno 1996), which added two records from Florida.

### The Vanuatu population

*Material examined.* VANUATU: 6 ♂♂, 6 ♀♀, Umeg, Aneityum, May, June, 1994, Fr A. Sacco.

Around 25 years ago, Fr Albert Sacco first noted the occasional white monarch at Anelghowhat on the SW coast of Aneityum (= Anatom), the southern-most island of the island chain that makes up Vanuatu. Some years later, white monarchs frequently were seen and collected by Fr Sacco at Umeg (= Umetch) on the SE coast of Aneityum, where they flew together with the orange form in a field where milkweed, *Asclepias* sp., was abundant. Form *nivosus* is now estimated by Fr Sacco to comprise around 20% of the *D. plexippus* population on Aneityum. Samson (1983) recorded *D. plexippus* from Aneityum but made no mention of a white form. No intermediate individuals between the white and orange forms have been noted.

Despite extensive observations of butterflies by Fr Sacco on other islands of Vanuatu, extending over more than 40 years of residency, form *nivosus* has not been sighted on any other island. Nor was form *nivosus* sighted by one of us (RBL) while collecting during the summer of 1987/88 on Efate, Ambrym and Malekula, and during September/October 1989 on Espiritu Santo.

All specimens of *nivosus* collected or sighted on Aneityum (Figs 1-2) were pinkish-white, unlike those from Hawaii which are nearly all grey-white. Only three specimens of the pinkish-white version are known from Hawaii (J. Stimson, pers. comm.).

### Discussion

The Vanuatu population is particularly significant because it is the only known established population of white monarchs apart from that in Hawaii. All other records involve chance encounters with single specimens rather than discernable populations. The size of the Vanuatu population (around 20% of the total *D. plexippus* population) is greater than that of Hawaii, which in 1988-89 reached its maximum density of approximately 8% (Stimson and Kasuya 2000), confirming that the Vanuatu population has been established for some years. The white monarchs of Hawaii were first noticed in 1965 (Mitchell 1966), at which time they were estimated at around 1% of the local population. This would suggest that the Vanuatu population may have established somewhere between 30-40 years ago and long after the establishment of monarchs through the Pacific islands in the latter half of the 19th century (Vane-Wright 1993).

One wonders why white monarchs have established colonies only on Oahu Island (Hawaii) and Aneityum Island (Vanuatu). It may well be a direct consequence of inbreeding the trait due to isolation. Stimson and Meyers (1985) have shown that form *nivosus* is the result of a simple autosomal recessive allele. If the populations of *D. plexippus* on Oahu and Aneityum Islands have few or no immigrant individuals, then inbreeding could easily increase the percentage of form *nivosus* individuals, providing that natural selection does not operate to eliminate homozygotes. Indeed, Stimson and Meyers (1985) hypothesised that the survival of white monarchs on Oahu is most likely because they are not at a selective disadvantage to the orange morph in the presence of bird predators. However, a more recent change in the behaviour of birds to seeking out larvae may now be a cause for the percentage decline in the number of white monarchs on Oahu (Stimson and Kasuya 2000).

The discovery of the Vanuatu population of white monarchs provides an opportunity for hybridization experimentation between the Hawaiian and Vanuatu populations, which for the first time may shed light on the origin of the '*nivosus*' gene. As Vane-Wright (1993) noted, if double heterozygous crosses of different origins produce an F1 population of only typical orange *D. plexippus*, then independent origins for form *nivosus* can be rejected. However, if the F1 population segregates into 3:1 then a single American origin is plausible, although this would not reject a multiple-origin possibility.





1



2

**Figs 1-2.** *Danaus plexippus*, form *nivosus*. (1) male upperside; (2) male underside.

### Acknowledgments

RBL thanks Fr Albert Sacco for considerable help and companionship during several collecting trips to Vanuatu and for providing the specimens examined. For the accompanying photographs we wish to thank Paul Overden, Australian Museum. John Stimson and Maiko Kasuya kindly made available to us a copy of their unpublished manuscript.

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**A REDESCRIPTION AND REASSIGNMENT OF  
*LUCIOLA GUERINI* BALLANTYNE  
(COLEOPTERA: LAMPYRIDAE: LUCIOLINAE)**

LESLEY A. BALLANTYNE

*School of Agriculture, Charles Sturt University, PO Box 588, Wagga Wagga, NSW 2678*

**Abstract**

The identity of *Luciola guerini* Ballantyne is confirmed and it is placed in the new combination *Atyphella guerini* (Ballantyne). Males and larvae are described.

**Introduction**

Ballantyne (1988) resolved confusion over the identities of *Luciola australis* (F.) and *Luciola guerini* Laporte. In Ballantyne (1988) *L. pudica* Olliff was synonymised with *L. australis* F. and specimens redescribed. *Luciola guerini* Laporte, a *nomen nudum*, was validated and an indication of its affinities given, although no specimens were associated. Recent studies (Ballantyne 1992, Ballantyne and Lambkin 2000) on the Australian and New Guinean fauna permit characterisation of *Luciola guerini* Ballantyne in the absence of a type specimen. Specimens conforming to Guérin-Ménéville's (1838) description have been found on New Ireland.

**Materials and methods**

Taxonomic characters are described in Ballantyne and Lambkin (2000). Abdominal sternites are not directly equivalent to ventrites; however visible abdominal sternites are called ventrites and are referred to by their actual number, which is one more than their visible number. Where possible, characters are given numbers and states to correspond to those used in Ballantyne and Lambkin (2000); e.g. head moderately exposed (4, 1) = character 4, state 1. Abbreviations for taxonomic characters are: FS, antennal flagellar segments; ML, median lobe of aedeagus; MPP, median posterior projection of V7; LL, lateral lobe of aedeagus; PLP, posterolateral projections of ventrite 7; V7, ventrite 7. Repositories of collections are: DAPM, Dept. of Agriculture, Port Moresby; BMNH, The Natural History Museum, London; UQIC, University of Queensland, Dept. of Zoology and Entomology, Brisbane. Alcohol preserved specimens from the indexed collection in UQIC are referred to by tube number for ease of relocation.

***Atyphella guerini* (Ballantyne), comb. nov.**

(Figs 1 – 6)

*Luciola guerini* Laporte, 1833: 151; Masters, 1886: 288; McDermott, 1966: 105 (partim); *nomen nudum*.

*Lampyris australis* F.; Boisduval, 1835: 125; Motschulsky, 1854: 53 (partim); misidentification.

*Lampyris australis* Guérin-Ménéville, 1838: 74; *nec* Fabricius, 1775: 201; 1787: 162; 1792: 102; 1801: 104. Type locality New Ireland.

*Luciola australis* Guérin-Ménéville; Lacordaire, 1857: 337.

*Luciola australis* (F.); Olivier, 1883: 330; 1885: 362; 1902: 74; 1907: 52; 1909: lxxxi; 1913: 417; Lea, 1909: 108 (partim); 1921: 197; misidentification.

*Luciola (Luciola) australis* (F.); McDermott, 1966: 105 (partim).

*Luciola guerini* Ballantyne, 1988: 164. Type locality Port Praslin, New Ireland; type not located.

**Material examined.** PAPUA NEW GUINEA (NEW IRELAND): 1 ♂, 15.iv.1937, J. Froggatt (BMNH); 1 ♂, Kavieng, 2°34'S 150°48'E, 11.ii.1966, G. Monteith (Tube 248, UQIC); 1 ♂, 6.iii.1966, A. Mann (DAPM); 2 ♂♂, Namatanai, 2.v.1940, G. Gee (DAPM, BMNH); 24 ♂♂, 2 larvae, Paruai Village, 30 miles south of Kavieng, 12.ii.1966, G. Monteith (Tube 237, UQIC; some specimens incomplete); 2 ♂♂, Konibiu Plantation, west coast, cacao block, resting on cacao tree, 5.vii.1955, J. Szent-Ivany (DAPM).

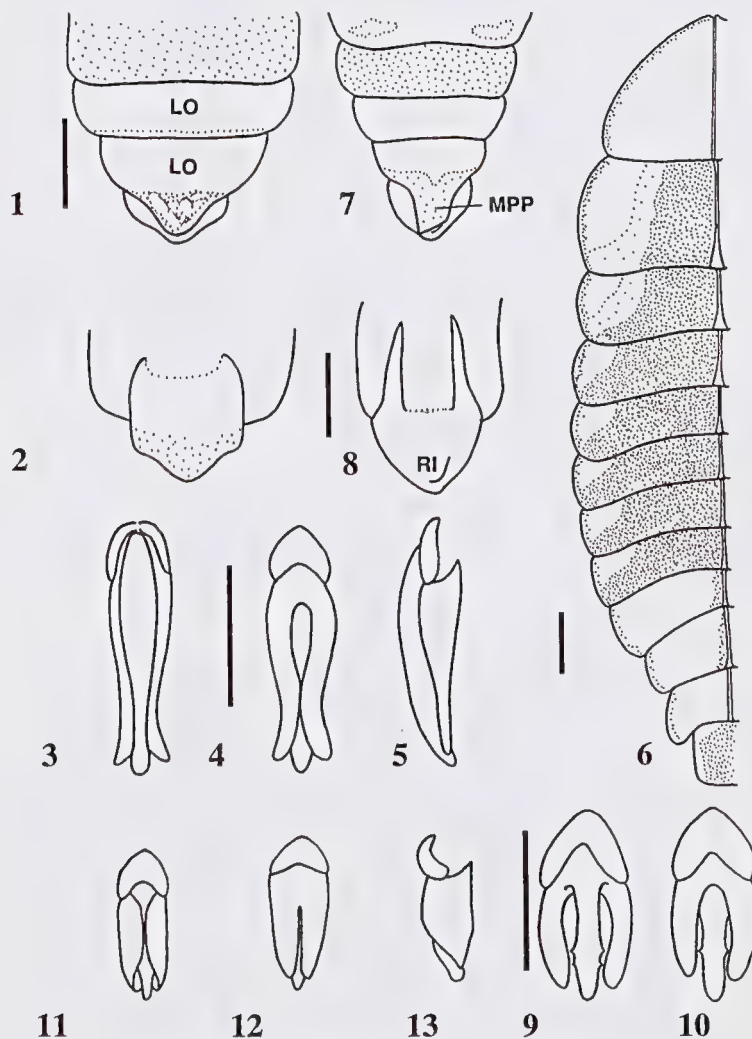
**Distinguishing features.** A fairly large (9-11 mm long) species with orange pronotum, very dark brown elytra, similar in size, shape and colour to *Luciola salomonis* Olivier and *Atyphella majuscula* (Lea), distinguished as follows:

*Atyphella guerini*: abdominal ventrites 2-4 mid-brown; ventrite 5 very dark brown; all abdominal tergites pale cream; MPP of V7 (Fig. 1) not considerably prolonged or sub-parallel-sided and with rounded apex; ventral surface of tergite 8 lacking longitudinal curved ridge in left lateral area (Fig. 2); aedeagus (Figs 3-5) length/width 5.2; lateral margins of ML at level of ejaculatory orifice not toothed; LL sub-parallel-sided, not very broad (in lateral view), closely approximate along their dorsal length and divergent in apical fifth; anterior margin of basal piece not produced dorsally. Larva (Fig. 6) with protergum and abdominal terga 7-9 mostly yellow, remainder extensively marked with reddish brown in median area.

*Luciola salomonis*: abdominal ventrites 2-4 yellow; ventrite 5 very dark brown; all abdominal tergites pale brown; MPP of V7 considerably prolonged, sub-parallel-sided and with obliquely truncate apex (Fig. 7); ventral surface of tergite 8 with longitudinal curved ridge in left lateral area (Fig. 8); aedeagus (Figs 9, 10) length/width 2.1; lateral margins of ML toothed at level of ejaculatory orifice; LL convex-sided, not very broad (in lateral view), widely divergent along their dorsal length; anterior margin of basal piece not produced dorsally. Larva not reliably associated (Ballantyne 1992).

*Atyphella majuscula*: abdominal ventrites 2-5 very dark brown; abdominal tergites 2-6 dark brown, tergites 7 and 8 pale yellow; MPP of V7 not considerably prolonged or sub-parallel-sided, with rounded apex; ventral surface of tergite 8 lacking asymmetrical ridges; aedeagus (Figs 11-13) length/width 2.5; lateral margins of ML at level of ejaculatory orifice not toothed; LL sub-parallel-sided, broad (in lateral view), closely approximate along their dorsal length except in apical seventh, where only the inner margins diverge. Larva dorsally pale with scattered brown markings more intense on terga 1-3 (Ballantyne and Lambkin 2000).





**Figs 1-13.** *Atyphella* and *Luciola* spp. (1-6), *Atyphella guerini* male; (7-10), *Luciola salomonis* male; (11 - 13), *Atyphella majuscula* male. (1, 7): ventral aspect, terminal abdomen. (2, 8): dorsal aspect, terminal abdomen. (3-5, 9-13): aedeagus (ventral 3, 9, 11; dorsal 4, 10, 12; left lateral 5, 13). (6): dorsal aspect, larva (left side only). Scale lines = 1 mm. Figures 1-2, 3-5, 7-8, 9-10 and 11-13 share scale lines.

LO = light organ; MPP = median posterior projection, ventrite 7; RI = ridge.

*Description of male.* 9-10 mm long; 4 mm wide. Pronotum, mesoscutellum, mesonotal plates bright orange yellow (85, 0), dorsal surface of abdomen pale orange (88, 1); elytra very dark brown, almost black (86, 0; 87, 0); head, antennae and palpi dark brown; ventral aspect of thorax pale brown; legs 1, 2 orange with dark brown apical fifth of tibiae, and dark brown tarsi; legs 3 orange, with light brown tibiae, and dark brown tarsi; abdominal ventrites 2-4 orange yellow, ventrite 4 may be light brown in lateral areas; ventrite 5 mid-brown; ventrites 6, 7 creamy white.

Pronotum 3.2-4.2 mm wide; 1.7-2.2 mm long; width/length 1.8-2.0; dorsal surface smoothly convex, lateral areas flattened; punctures on disc small, shallow, contiguous or separated by up to width of puncture; midanterior margin of pronotum scarcely produced and broadly rounded; anterolateral corners rounded obtusely; lateral margins diverging along anterior half or more (2, 0), not indented near posterolateral corners (5, 0) and flattened more widely in posterior half (8, 3); posterolateral corners rounded, not projecting strongly beyond posterior margin (6, 0).

Elytra with punctuation not conspicuously larger than that of pronotum (10, 0); lateral margins slightly convex-sided (17, 1); with 4 interstitial lines of which lines 1, 2 are as well elevated as sutural ridge, lines 3 and 4 not as well elevated (14, 0); epipleuron not widely expanded in basal half; epipleuron and suture extend to apex of elytron (15, 0; 16, 0), but are not thicker in apical half (13, 0); apex not deflexed (11, 0).

Head moderately exposed in front of pronotum at rest (4, 1); vertex moderately excavated (18, 1); greatest head width 2.0-2.2 mm; smallest interocular width 0.3 mm; eyes moderately separated above labrum (29, 1); antennal socket distance < antennal socket width (antennal sockets very close but not contiguous) (22, 1); mouthparts functional (28, 0); apical segment of labial palpi flattened and dentate on inner margin (39, 1); labrum about as wide as long (26, 1); clypeolabral suture flexible (27, 0); frons 2-3 times antennal socket width, frons vertex junction rounded (23, 0), not elevated in median line (24, 0); eyes moderately separated ventrally (19, 1); posterolateral eye excavation absent (20, 0). Antennae 11-segmented (34, 0), longer than, but less than twice, greatest head width (21, 1); scape and pedicel not produced laterally; flagellar segment 1 longer than pedicel (30, 0); all FS elongate, slender, 2-3 times as long as wide, 7-9 not conspicuously shorter than rest (33, 0); no FS flattened (37, 0), expanded or produced laterally (31, 0; 32, 0; 36, 0); apical segment rounded (35, 0).

Legs lacking metafemoral comb (41, 0); femora and tibiae not curved or swollen along their length or at their apices (42, 0; 43, 0; 44, 0; 45, 0).

Abdomen basal abdominal sternites lacking recurved posterior margins; median longitudinal carina, dimple and trough absent from median ventral surface of V7 (53, 0; 54, 0; 62, 0); posterior margin of V7 (Fig. 1) lacking



incurving hairy lobes or pointed projections (60, 0; 61, 0); light organ in V7 entire (47, 0), reaching sides but not posterior margin of MPP (diffuse fat body extends into MPP) (48, 1) and occupying more than half the area of V7 (49, 0); posterior half of V7 not arched or swollen (56, 0); MPP symmetrical, about as long as broad (51, 1) and narrower than half the width of V7, apically rounded (50, 2), lateral margins converging posteriorly and not engulfed by the apex of tergite 8 (52, 0); MPP lacking median longitudinal trough on ventral surface (55, 0); PLP not developed (57, 0; 58, 0; 59, 0); tergite 8 (Fig. 2) about as wide as long (68, 0), posterior half not abruptly narrowed (69, 0); ventral face of tergite 8 lacking a median longitudinal trough, depressed lateral troughs (64, 0) or any longitudinal developments margining a median area (65, 0); flanges (63, 0), asymmetrical projections and transverse ridges or hooks absent (66, 0); bifurcate anterior margin of tergite 8 about as wide as long (67, 0) and prolongations broad and apically rounded.

Aedeagal sheath sternite asymmetrical in posterior half (70, 1); not extremely long and narrow (71, 0); lacking paraprocts (72, 0); tergite 9 about as long as wide (73, 0).

Aedeagus (Figs 3-5) symmetrical (81, 0); elongate, slender, about 5 times as long as wide; maximum width across LL at their bases/maximum width of ML at same point about 2/1 (74, 1); ML slightly longer than LL (77, 1), not inclined ventrally (75, 0) and preapical area not produced (76, 0); LL separated for longer than half their dorsal length (78, 0), lacking fleshy lobes (82, 0), about as wide at their apices as widest point of ML (79, 1), not separated into broad basal and narrowed apical section (80, 0) and extending to either side of ML at their apices (apices are visible from beneath) (83, 0); basal piece not hooded.

*Larva* (Fig. 6). Lateral margins of terga 1-11 explanate (97, 2), densely covered with very short stout spines and thickened (seen best from beneath) (99, 1); median line (from anterior margin of tergum 1 to posterior margin of tergum 11 not elevated or laterally ridged or margined (102, 0); punctures in anterior half of terga 2-11 not conspicuous, slightly larger than punctures over rest of each tergum (103, 1). Protergum 2.2-2.4 mm long, 3.0-3.3 mm wide (98, 2); median anterior margin barely indented; not narrowed in anterior sixth and lacking anterolateral tubercles (100, 0); posterolateral corners of protergum (101, 0) and terga 2-11 rounded, not produced. Posterolateral corners of terminal tergum not produced (104, 0). Head wider than long, anterior margin widely medianly emarginate. Protergum mainly yellow with narrowly pale brown margins; terga 2-8 with wide dark reddish-brown median marking, extreme lateral margins pale brown, remainder pale yellow (the body outline is visible through the paler tergal margins); terga 9-11 mainly yellow, 9 and 10 with a narrow median dark marking along the median line; tergum 12 mainly dark with lateral margins narrowly yellow.

Ventral surface of thorax mainly yellow with irregular dark markings; ventral abdomen yellow except for very dark brown epipleural plates of sterna 4-8 (spiracles in these plates are pale) and light brown sterna.

### Discussion

Arrangement of taxa in the Luciolinae follows Ballantyne and Lambkin (2000), who ran a cladistic analysis (using 104 characters and 44 lucioline taxa) that defined the distinctiveness of the genus *Atyphella* Olliff. *A. guerini* differs from a similarly coloured Australian species, *A. majuscula*, in only one male character and in certain larval features including coloration (other features of difference such as male ventral coloration and shape of the aedeagal basal piece were not used in Ballantyne and Lambkin's analysis). This character is 65: developments of the ventral face of tergite 8 [*A. majuscula* has state 2; *A. guerini* shares state 0 with 20 of the 23 species assigned to *Atyphella*]. *A. guerini* shares laterally explanate tergal margins with all known *Atyphella* larvae.

### Acknowledgments

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